FOLIO OF THE PHILIP SMITH MOUNTAINS QUADRANGLE, ALASKA
MISCELLANEOUS FIELD STUDIES
MAP MF-879B
SHEET 1 OF 2

BROSGE AND OTHERS —BEDROCK GEOLOGY

Base from U.S. Geological Survey, 1956
Location of Alyeska Haul Road approximate

SCALE 1:250000

5 0 5 10 15 20 25 KILOMETERS

CONTOUR INTERVAL 200 FEET
DATUM IS MEAN SEA LEVEL

Geology by: A.L. Bowsher, J.T. Dutro Jr., 1949; W.P. Brosgé, H.N. Reiser, 1950, 1952, 1960; A.S. Keller, R.L. Detterman, 1951; W.P. Brosgé, H.N. Reiser, C.L. Whittington, 1958; J.L. Tailleur, 1965; R.L. Detterman, 1969, 1972; H.N.Reiser, J.T. Dutro Jr., 1974; H. N. Reiser, W.P. Brosgé' J. T Dutro Jr., R.L. Detterman, 1975, 1976. N.J. Silberling, 1976

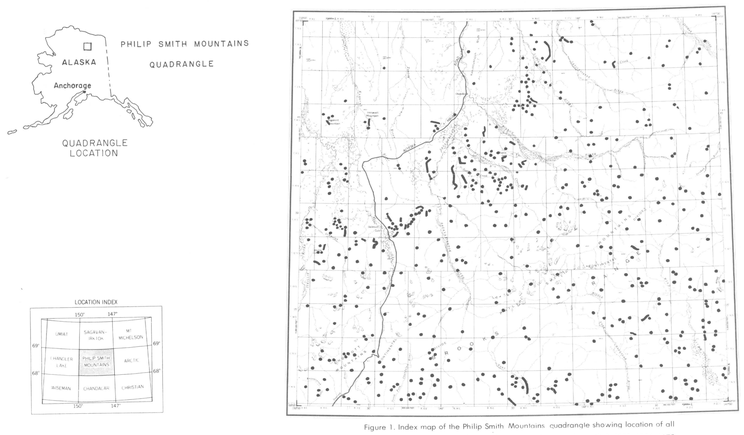
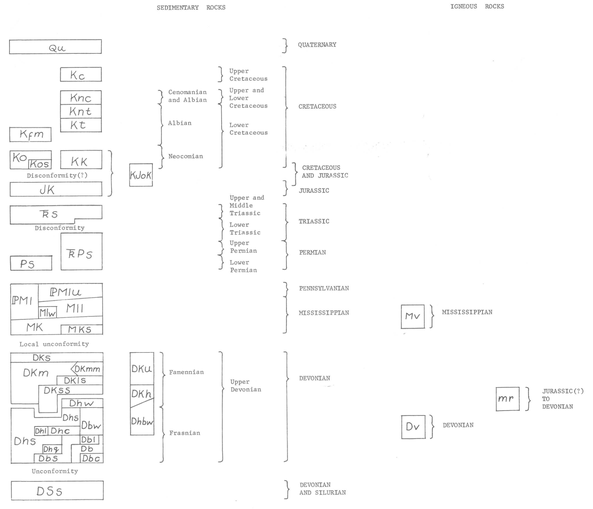


Figure 1. Index map of the Philip Smith Mountains quadrangle showing location of all geologic stations (dots) and traverse (lines) made in 1960, 1972 1974, 1975, 1976, and stations and traverses made in Paleozoic rocks in 1949, and 1950.

CORRELATION OF MAP UNITS



BEDROCK GEOLOGIC MAP OF THE PHILIP SMITH MOUNTAINS QUADRANGLE, ALASKA

BY
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1979

DESCRIPTION OF MAP UNITS

SEDIMENTARY ROCKS

Qa **Qc** SURFICIAL DEPOSITS, UNDIVIDED (Quaternary) -- Mostly glacial and alluvial deposits. Mapped and described in detail by Hamilton (1978)

Kc COLVILLE GROUP (Upper Cretaceous) -- Gray to olive-gray; medium bedded to massive quartz arenite to volcanic wacke with interbeds of laminated siltstone and shale, and abundant plant debris and coal fragments; some yellow-weathering very fine grained laminated vitric tuff. Mostly nonmarine. Exposed thickness about 60 m

Knc NANUSHUK GROUP (Upper and Lower Cretaceous). In this quadrangle includes:

CHANDLER FORMATION (Upper and Lower Cretaceous) -- Massive pebble to cobble conglomerate composed mainly of chert and quartz clasts; quartz arenite to quartz wacke, medium-bedded to massive; interbedded carbonaceous shale and siltstone, minor coal beds less than 30 cm thick. Scour marks and crossbedding common. Fluvial and shallow marine. Late Cretaceous (Cenomanian) pelecypods and Early Cretaceous (Albian) charetopods. (See Table 1). Exposed thickness 440 m

Knt TUKTU FORMATION (Lower Cretaceous) -- Gray; fine to very fine grained; thin to medium-bedded quartz wacke; ripple marked and crossbedded; interbedded micaceous siltstone and shale more common in lower part. Flute casts, load casts and drag marks common. Marine. Early Cretaceous (Albian) pelecypods, and cephalopods (see Table 1). Thickness 150 m

Kt TOROK FORMATION (Lower Cretaceous) -- Dark-gray, laminated and cross-laminated, silty clay shale and siltstone, with thin limestone interbeds and abundant marcasite nodules; minor very fine grained sandstone. Marine. More than 130 m thick

Kfm FORTRESS MOUNTAIN FORMATION (Lower Cretaceous) -- Cyclic units of polymictic conglomerate, lithic wacke, siltstone and shale; rocks in upper cycles generally finer grained and thinner bedded than those in lower cycles. Conglomerate composed of well-rounded cobble to granules of black, gray and green chert, and minor white quartz, granules of basalt, and igneous rock; massive to medium bedded. Lithic wacke, dusky yellow green to dusky yellow gray coarse to fine grained; massive to thin bedded. Siltstone and shale dark gray. Carbonized plant debris throughout. Marine and nonmarine. Early Cretaceous (Albian) pelecypods (see Table 1). Thickness 1,300 m

Ko OKPIKRUAK FORMATION (Lower Cretaceous) -- Siltstone and shale in lower part grading into chemically-bedded dark gray siltstone, graywacke and minor conglomeratic beds in upper part. Thin limestone beds and concretions locally abundant; pelecypod chert pebbles locally in shale in northern outcrops; coquina bed near base. Marine. Early Cretaceous (Valanginian) pelecypods (Buchia sp.) in coquina near base of formation; indeterminate bivalves and pelecypods in higher parts of formation (see Table 1). Thickness more than 600 m

Kos Sandstone and shale member -- Tan; fine grained; medium bedded, quartz arenite beds interbedded with shale locally in lower part of formation

Kk KONGAKUT FORMATION (Lower Cretaceous) -- Dark gray to black, manganiferous shale and siltstone with interbeds of fine-grained dark graywacke; nodules and lenticular beds of red-weathering clay ironstone; polished black chert pebbles in lower part. Marine. Early Cretaceous (Neocomian) pelecypods. (see Table 1). Thickness more than 300 m. Lateral (northern) equivalent of Okpikruak Formation

KJok OKPIKRUAK FORMATION, KONGAKUT FORMATION, AND KINGAK SHALE, UNDIVIDED (Lower Cretaceous and Jurassic) -- Includes a small outcrop of black siltstone and mudstone near Lupine River containing pelecypods of Late Jurassic and Cretaceous aspect; Kongakut and Okpikruak mapped as a complex fault zone on Atigun River including Lower Jurassic Kingak Shale and graywacke and coquina beds of the Okpikruak Formation

Jk KINGAK SHALE (Jurassic) -- Dark gray, gun-metal blue weathering; hard siltstone with shale interbeds; abundant nodules of clay ironstone and marcasite. Southwest of Ribbon River consists only of a local unit of black organic clay shale that is too thin to map. This unit is included in undivided Jurassic and Cretaceous rocks (KJok) on Atigun River, but may also be present in some poorly exposed areas mapped either as Kongakut or Okpikruak Formation. Marine. Middle and late Jurassic ammonites and pelecypods in northeastern part of unit; Early Jurassic pelecypods in southwestern part (see Table 1). Thickness about 370 m in northeast; 30 m or less in southwestern part of unit.

Ts Ps SHUBLIK FORMATION (Upper, Middle, and Lower Triassic) -- Upper part: dark gray to black, calcareous, phosphatic siltstone and shale, with thin gray limestone interbeds; variolored chert beds present locally southwest of Accomplishment Creek; limestone concretions locally abundant. Lower part: black clay shale, locally weathers rusty; limestone concretions and laminated silty limestone beds. Lower part probably absent northeast of Accomplishment Creek. Marine. Late Triassic pelecypods and ammonites, and Middle Triassic pelecypods in upper part; Early Triassic pelecypods in lower part (see Table 1). Thickness about 70 to 150 m

Ps SADLEROCHIT GROUP (Lower Triassic and Permian) -- Composed of Ivishak Formation (Lower Triassic) and Echooka Formation (Permian), which are not shown separately on this map. For graphic logs of twelve measured sections of Sadlerochit Group in this quadrangle see Detterman (1976).

Ivishak Formation -- Laminated gray siltstone and shale in upper third; massive, fine-grained quartz arenite in middle third; gray laminated shale and siltstone with abundant limestone nodules and concretions, and locally with barite nodules in lower third. Marine. Early Triassic ammonites and pelecypods (see Table 1). Thickness about 550 to 720 m in the north, about 170 m in the south

Echooka Formation -- Calcareous siltstone and shale; local thick units of thin- to medium-bedded limestone; siliceous siltstone and massive quartz arenite beds in upper part. Marine. Early Permian brachiopods; early late Permian brachiopods locally northeast of Lupine River (see Table 1). Thickness about 110 m to 260 m

PMl SIKSIKPUK FORMATION (Lower Permian) -- Black shale and argillite, green and red pyritic slate and argillite, and gray fissile siliceous siltstone that weathers orange; barite nodules. Recognized only south of Continental Divide in T. 14 S., R. 22 E., and T. 15 S., R. 21 E. Marine. No fossils found. Incomplete thickness preserved, about 70 m

PMlu Mll LISBURNE GROUP, UNDIVIDED (Pennsylvanian and Mississippian) -- Gray limestone and dolomite, shaley limestone, nodular chert. Marine. About 700 to 1,000 m thick. For measured sections in and near this quadrangle see Bowsher and Dutro (1949); Armstrong and others (1970); Brosgé and others (1962); Armstrong and Mamet (1977 [1978]); Armstrong and Mamet (in press). In those sections Lisburne is divided formally into Wachsmuth Limestone (lower part of Mississippian) and Wahoo Limestone (Upper Mississippian) and Wahoo Limestone (Upper Mississippian, Lower and Middle Pennsylvanian). Wachsmuth Limestone very thin to absent north of Ribbon River; Wahoo Limestone probably absent south of a line from T. 13 S., R. 9 E. to T. 9 S., R. 22 E. In reconnaissance mapping of this quadrangle, Lisburne Group is divided informally into upper and lower parts, mainly on the basis of dominant weathering color. Wachsmuth Limestone is mapped separately only near Itkillik Lake

PMlu Upper part of Lisburne Group -- Includes upper part of Alapah Limestone and Wahoo Limestone. Generally weathers light to medium gray. Mostly dark to medium gray, fine- to medium-grained limestone and dolomite, and black to light-gray nodular chert, with much silicified limestone. In Itkillik Lake-Galbraith Lake area, a marker zone of black dolomite and chert occurs near middle of unit. Upper 100-200 m commonly includes much white-weathering coarse-grained and very fine grained limestone, light gray nodular chert, some orange-weathering pyritic limestone, and locally a few tiny crystals and veinlets of fluorite. Top bed commonly black massive chert. Bottom contact indefinite and variable. Marine. Late Mississippian corals and brachiopods, Pennsylvanian brachiopods, and, in upper 30 m near Galbraith Lake, brachiopods that may be Early Permian (see Table 1). Late Mississippian (Chesterian) and Early Pennsylvanian foraminifera common; Late Mississippian (Meramecian) foraminifera near base in northwesternmost outcrops; Late Mississippian (Chesterian) to Middle Pennsylvanian foraminifera in interval near Galbraith Lake that contains the Early Permian(?) brachiopods. (Armstrong and others, 1970; K. J. Bird, written communs., 1977, 1978). Thickness about 200 to 700 m

Mll Lower part of Lisburne Group -- Includes lower part of Alapah Limestone, and, south of Ribbon River, also includes Wachsmuth Limestone. Generally weathers dark to medium gray. Mostly dark gray fine- to medium-grained limestone and dolomite, with much thin-bedded to shaley limestone, abundant black nodular chert, and much silicified limestone. Light gray weathering dolomite and coarse-grained limestone locally in lower part. Marine. Late Mississippian brachiopods and corals, and also, in southern half of quadrangle, Early Mississippian brachiopods (see Table 1); Late Mississippian (Meramecian and Chesterian?) foraminifera (K. J. Bird, written communs., 1977, 1978); Armstrong and others, 1970). Thickness about 300 to 500 m or more

Mlw WACHSMUTH LIMESTONE (Upper and Lower Mississippian) -- Bioclastic limestone, dolomite and dolomitic limestone, black nodular chert; in lower part much argillaceous and shaley limestone and minor shale. Differentiated only where mapped by Bowsher and Dutro (1949) near Itkillik Lake. Marine. Late Mississippian (Meramecian) and Early Mississippian (Osagean) foraminifera (Armstrong and others (1970). Thickness about 260 to 670 m

MKs KAYAK SHALE (Mississippian) -- Mostly black, fissile clay shale and silty shale, in part rusty-weathering, with small ironstone nodules; interbedded with orange-weathering siltstone in southern half of quadrangle. Fossiliferous limestone in lenses and in beds as much as 10 m thick, abundant in upper part; is generally dark gray, argillaceous or shaley; weathers yellow, orange, or olive, and locally contains nodular black chert. Thin beds and lenses of gray and brown, irregularly bedded fine- to medium-grained, impure, partly worm-burrowed sandstone near base. Basal rusty-weathering quartzite locally in southeastern corner of quadrangle. Rests with apparent conformity on Kanayut Conglomerate in most of quadrangle, and with probable unconformity on Hunt Fork Shale and older rocks in southeastern corner of quadrangle. Marine. Early Mississippian brachiopods and plants (see Table 1); late Mississippian (Meramecian) foraminifera in northern half of quadrangle (K. J. Bird, written commun., 1977). Generally about 250 to 350 m thick; about 100 m thick in southeastern part of quadrangle

MKs Shale and sandstone member -- Distinguished from the rest of the Kayak Shale by more abundant sandstone and hard, silica-cemented quartzite and by less abundant limestone. Mostly black and orange weathering, partly micaceous clay and silty shale and nodular ironstone interbedded with as much as 25 percent black and orange-weathering, locally carbonaceous, siltstone and 10 to 25 percent argillaceous fine-grained, thin-bedded to shaley sandstone and gray, fine- to medium-grained, thin- to thick-bedded quartzite. Rare lenses of orange-weathering fossiliferous limestone. Carbonized plant fragments in shale and siltstone. Marine and possibly nonmarine. Early Mississippian brachiopods and Mississippian(?) plants (see Table 1). About 350 m thick. Probably consists mostly of lower part of formation. As mapped, may include some infolded quartzite beds of Kanayut Conglomerate.

DKs KANAYUT CONGLOMERATE (Upper Devonian) -- Divided into:

Stuver Member -- Mostly shale, shaley siltstone and thin-bedded sandstone and quartzite; minor conglomerate. Shale and siltstone, micaceous red, green, brown, and black. Sandstone, ferruginous, micaceous, shaley, and fine grained. Quartzite, firmly cemented by silica, is gray, greenish gray or hematitic; mostly thin to medium bedded, partly crossbedded; fine to medium grained. Conglomerate and conglomeratic quartzite of chert and quartz pebbles occur locally at base of fining-upward cycles of quartzite and sandstone. Weather-weathers to dark brown and orange slopes in western half of quadrangle; red shale more conspicuous in eastern half. Nonmarine. Unidentified plant fragments in black shale. As much as 500 m thick; locally absent

DKm Middle conglomerate member -- Mostly gray- to rusty orange-weathering conglomerate, quartzite, and sandstone in cliff-forming units about 10 to 70 m thick, separated by less resistant units of shaley siltstone and impure sandstone. Conglomerate pebbles mostly of variicolored chert and white quartz, with minor amounts of quartzite, and, in southernmost part of quadrangle, with abundant slate pebbles. Near south edge of quadrangle, pebbles are somewhat angular. Quartzite forms matrix of conglomerate and also occurs in thin to massive, partly crossbedded nonconglomeratic beds that are generally gray quartzite, firmly cemented by silica, but include some brown-weathering beds and irregular patches that are partly cemented by calcite. Quartzite locally contains about 1 percent fresh plagioclase grains. Pyrite and hematite disseminated in matrix of conglomerate are common along and south of Continental Divide; pyrite locally concentrated on bedding planes and in plant fragments. Quartzite locally sericitized. Interbedded units of less resistant rocks are composed generally of red and green, locally manganiferous shale; dark red, grayish green, yellow, and gray thin-bedded fine-grained ferruginous sandstone and siltstone; and minor amounts of black shale and siltstone; in southern Your Creek area less resistant rocks are mostly black slate. In north-ern part of area proportion of resistant beds in the member decreases downward to about 40 percent in lower part, and contact with underlying lower shale member is gradational. In southern part of area, member rests directly on sandstone member or on Hunt Fork Shale. Almost entirely nonmarine; contains fossiliferous marine beds near base in southern part of area. Unidentifiable coaly plant fragments common in shale, fine-grained sandstone and conglomerate. Late Devonian (Famennian) brachiopods and unidentified clams locally in lower part (see Table 1). Estimated thickness about 500 to 700 m in north; about 300 to 500 m in south. Includes:

Dkmm Massive marker bed -- Conglomerate and coarse-grained sandstone about 200 m thick

Dkls Lower shale member -- Mostly (60 to 80 percent) red, grayish green and manganiferous brown shale containing thin beds of brown and grayish-green ferruginous sandstone. Proportion of shale increases downward through member. Interbedded units of more resistant rock about 2 to 20 m thick are typically fining-upward sequences of gray and brown granule or pebble conglomerate, gray conglomeratic quartzite and gray or brown thin- to medium-bedded limonitic sandstone; partly calcareous; partly crossbedded. Local black shale with coal. Upper part forms low-rel ief slopes banked with gray cliff-forming beds; lower part forms brown and red slopes. Nonmarine. Unidentified plant fossils in sandstone and shale. Estimated thickness in northern part of map area about 830 m; absent in southern part. Probably grades laterally into nortwern facies of sandstone member near Itkillik River

Dkss Sandstone member -- Generally brown and gray weathering, thin, tabular-bedded, slightly calcareous limonitic sandstone, interbedded with black shale and ironstone. Some gray quartzite; conglomeratic sandstone rare. Ferruginous lenses of chert and ironstone pebbles and small and brachi-opod shells at several localities; one 15-cm bed of argillaceous limestone. Rare plant fragments. Generally forms slopes that weather brown and orange. In outcrops near Itkillik River at and nor.h of latitude 68° 15', sandstone mostly light gray, limonitic, part/ calcareous, thin to thick bedded; white quartzite and white conglomerate of granules and small pebbles common at base of fining-upward sequences; shale grayish green, brown, red, and gray, with iron-one concretions. Rare plant fragments. Forms buff and white slopes. Marine in most of mapped area; probably marine and nonmarine in northwest part. Late Devonian (Famennian and Frasnian) brachiopods common in northwest (see Table 1). Estimated thickness about 400 to 600 m near Itkillik River, about 300 m near south edg of quadrangle; absent in parts of area; apparently pinches out soot-eastward, and grades northeastward into lower shale member

Dku Stuver Member, middlo conglomerate member and lower shale member, undivided -- Quartzite and conglomerate, partly rusty weathering. abundant red shale

Dhw HUNT FORK SHALE (Upper Devonian). Divided into:

Wacke member -- Mostly (50 to 80 percent) grayish green, brown, and black micaceous nanganiferous clay shale and shaley siltstone. Interbedded thin- to medium-bedded, fine- to medium-grained, limonitic quartzitic quartz-chert wacke that weathers orange and brown, green fine-grained wacke, and minor amounts of gray quartzite and calcareous sandstone. Wacke composed of fragments of quartz, chert, muscovite and biitite schist, and minor amounts of plagioclase feldspar. Ferruginous lenses contain brachiopod coquina and pebbles of chert and shale and ironstone. Plant fragments common. Some load casts and worm burrows. Weathers to brown and greenish gray slopes. Marine. Late Devonian (Famennian) brachiopods common (see Table 1). Estimated thickness about 500 to 700 m in northern part of area; absent in south. Rests on shale member of Hunt Fork. Locally rests on limestone member of unnamed unit of brown calcareous clastic rocks near middl: of quadrangle, and apparently rests on older wacke of unnamed unit in eastern part.

Dhs Shale member -- Dark-gray to medium-gray, fissile, laminated clay shale and slate, silt/shale and slate, and micaceous siltstone; few limestone concretion.; weathers black to brown; locally pyritic and weathers rusty. Interbedded with as much as 25 percent brown-weathering, thin-bedded fine-grained, partly calcareous sandstone and gray- to orange-weathering, thin- to thick-bedded, fine- to medium-grained sandstone, including both quartz-chert arenite and quartz-chert wacke; sandstone schistose in southern part of area. Minor thin beds of ferruginous, argillaceous, fossiliferous limestone. Cyclic depositional pattern evident, with siltstone grading upward into shale; limestone in upper parts of some cycles; cycles 40 to 150 m thick. Thicker limestone beds and persistent zones of calcareous sandstone mapped separately as limestone member and calcareous sandstone member. Marine. Late Devonian (Frasnian) brachiopods and corals (see Table 1). Estimated thickness from 500 m near south edge of quadrangle to more than 700 m to the north. Contacts with overlying and underlying Upper Devonian clastic rocks probably gradational

Dhl Limestone member -- Dark-gray limestone, that weathers yellow, brown, and gray; thin to medium bedded or nodular; algal lumps common. Commonly argillaceous and locally interbedded with black shale; arenaceous near Dietrich River. Commonly includes some orange-weathering partly calcareous siltstone and fine-grained sandstone above or below the limestone. Marine. Late Devonian (Frasnian) brachiopods and corals (see Table 1). Member composed of lenticular beds about one to 15 m thick that occur mostly in a persistent zone as much as 50 m thick about 200 or 300 m below top of Hunt Fork Shale. Pinches out laterally into cilcareous sandstone

Dhc Calcareous sandstone member -- Sandstone and shale that weather light brown and orange Sandstone mostly thin bedded, very fine to fine grained, partly o highly calcareous; minor amounts of noncalcareous medium- to thick-bedded, fine- to medium-grained sandstone. Clay shale and shaley siltstone dark-gray to grayish-green, locally manganiferous; contain thin beds of orange-weathering limestone at one locality. Plant fragments at one locality. Marine. Late Devonian (Frasnian) brach opods common (see Table 1). Thickness probably less than 300 m. Grades laterally int: limestone member of Hunt Fork Shale in western part of quadrangle; probably grades into wacke and limestone member of unnamed unit of brown calcareous clastic rocks in eastern part

Dbq Quartzite member - Fine-grained quartzite that weathers dark gray to rusty orange, and some calcareous sandstone; interbedded with black slate and siltstone. Probably marine. No fossils found. Estimated thickness 150 to 200 m. Structural and stratigraphic contacts with both Hunt Fork Shale and brown shale member of unnamed unit beneath Hunt Fork

Dkh SANDSTONE MEMBER OF KANAYUT CONGLOMERATE AND WACKE MEMBER OF HUNT FORK SHALE, UNDIVIDED -- Forms brown and dark gray shaley slopes and cliffs. Beds in western part strike into wacke member; those in eastern part are mostly sandstone member

Dbw *UNNAMED BROWN CALCAREOUS CLASTIC ROCKS (Upper Devonian). Divided into:

Wacke member -- Sandstone and shale that weather brown and orange. Sandstone mostly limonitic, thin-bedded, calcareous and noncalcareous, micaceous, fine-grained, quartz-chert wacke; some gray quartzite and very fine grained shaley sandstone. Clay shale and shaley siltstone brown, grayish green, and black, manganiferous, micaceous. Local calcareous conglomerate and black siliceous siltstone. Weathers to brown smooth slopes. Apparently contains less green shale and siltstone, and more calcareous sandstone than wacke member of Hunt Fork Shale. Marine. Late Devonian (Frasnian) brachiopods and corals (see Table 1). Thickness uncertain; more than 200 m thick in eastern part of quadrangle; absent in western and southern parts. Probably grades laterally into calcareous sandstone member of Hunt Fork Shale, and vertically into wacke member of Hunt Fork Shale

Dbc Brown shale member -- Mostly light-brown and orange-weathering partly calcareous gray and greenish-gray shale, slate and shaley micaceous siltstone, and dark-gray and rust-weathering noncalcareous black shale and slate; ironstone and siltstone concretions common. Interbedded brown-weathering, partly calcareous, thin-bedded, fine-grained, micaceous sandstone and brown and gray, thin to medium-bedded micaceous, fine-grained quartzite, including both quartz-chert arenite and wacke. Contains lenses and beds of conglomerate of chert, quartz and shale pebbles. Few thin beds and lenses of fossiliferous limestone. Forms light-brown and yellow slopes. Distinguished from shale member of Hunt Fork Shale by brown-weathering color and common occurrence of slightly calcareous shale. Marine. Late Devonian (Frasnian) brachiopods and corals (see Table 1). Probably as much as 300 m thick; locally absent. Grades laterally into brown sandstone, shale and limestone member, and probably grades laterally and vertically into Hunt Fork Shale

Dbl Limestone member -- Gray-weathering dark-gray limestone, commonly fetid or carbonaceous; commonly overlain by, underlain by or interbedded with brown- and orange-weathering argillaceous or shaley limestone and minor amounts of brown sandstone. Abundant corals and stromatoporoids. Marine. Late Devonian (Frasnian) corals and brachiopods (see Table 1). Mounds, lenses and beds usually 10 to 20 m thick, as much as 100 m thick

Db Brown sandstone, shale, and limestone member -- Highly variable sequence of interbedded shale, sandstone, limestone and conglomerate. Upper part mostly brown, gray and black shale and siltstone interbedded with as much as 20 percent brown-weathering sandstone, limestone units 2 to 20 m thick, and beds of chert and siltstone pebble conglomerate; typically in cyclic sequences about 100 m thick composed of calcareous sandstone and local conglomerate, grading up through siltstone and shale to massive coral-stromatoporoid reefs capped by brown-weathering silty coquinoid limestone. Thicker units of limestone mapped separately as parts of limestone member. Lower part commonly includes yellow and orange-weathering, thin-bedded, laminated black fine-grained limestone with shale partings, interbedded with black shale and slate and with calcareous and noncalcareous conglomerate composed of chert, shale and some quartz pebbles; locally includes brown-weathering calcareous shale and very thin bedded calcareous fine-grained quartz-chert wacke, and grayish green, manganiferous shale, argillite and fine-grained wacke. Rocks sheared, schistose and slaty in much of area. Marine. Late Devonian (Frasnian) brachiopods and corals (see Table 1). As much as 600 m thick; locally absent; grades laterally into rocks near member

Dbc Conglomerate member -- Maroon, purple, green, and gray conglomerate composed of chert, slate, limestone, and quartz pebbles; maroon, green, and greenish-gray argillite, slate and phyllite, locally interbedded black siltstone and gray micaceous sandstone. At one locality includes more than 100 m of black, hematitic conglomeratic limestone containing granules of quartz and chert and abundant siltstone. Probably marine. Late Devonian (Frasnian) brachiopods in the conglomeratic limestone (see Table 1). Present only locally; as much as 250 m thick

Dbw WACKE MEMBER OF HUNT FORK SHALE AND WACKE MEMBER OF UNNAMED BROWN CALCAREOUS CLASTIC ROCKS,UNDIVIDED -- Contains Late Devonian (Frasnian and Famnenian) brachiopods (see Table 1)

Dbs SKAJIT LIMESTONE (Upper Devonian and Silurian) -- Gray-weathering, light to dark-gray limestone and dolomite, mostly recrystallized or with slatey cleavage; rare chert nodules. In southeast part of quadrangle top beds partly replaced by massive or brecciated black recrystallized chert in discontinuous layer 1 to 10 m thick that commonly contains pyrite and other sulfides. Marine. Middle(?) Devonian pelecypods and late(?) Silurian brachiopods (see Table 1). Estimated thickness at least 600 m; base not exposed

IGNEOUS ROCKS

mr MAFIC ROCKS (Jurassic? to Devonian) -- Orange- and dark-green-weathering clinopyroxene-spilite and diabase, commonly altered to calcitic greenstone; commonly schistose near margins. Occur in bodies 1 to 100 m thick, some with fine-grained chilled margins, as concordant sills with hornfels in the adjacent slate. Most layers probably sills; some may be flows. K-Ar age of 363 ± 11 m.y. (M. L. Silberman, written commun., 1977) determined for albite in sill north of Middle Fork of Chandalar River (S. 24, T. 13 S., R. 18 E.)

Mv VOLCANIC ROCKS (Mississippian) -- Sill of chloritized andesite and diorite, composed of andesine, chlorite, actinolite, calcite (see Keller, Morris, and Detterman, 1961). Crops out only in north part of quadrangle. Correlated with dikes, sills, and andesitic flow and tuff in Mississippian part of Lisburne Group about 10 km farther north.

Dv VOLCANIC ROCKS (Devonian) -- Pillow basalt, amygadaloidal basalt, and basalt capped by tuffaceous limestone; commonly schistose and altered to calcitic greenstone; may in part have been olivine basalt. Flows, about 10 to 80 m thick, intertongue with lower part of Hunt Fork Shale (Upper Devonian) and with unnamed brown calcareous clastic rocks (Upper Devonian)

REFERENCES

Armstrong, A. K., Mamet, B. L., and Dutro, J. T., Jr., 1970, Foraminiferal zonation and carbonate facies of carboniferous (Mississippian and Pennsylvanian) Lisburne Group, Arctic and northern Brooks Range, northern Alaska: American Association of Petroleum Geologists Bulletin, v. 54, no. 5, p. 687-698.

Armstrong, A. K., and Mamet, B. L., 1977 [1978], Carboniferous microfacies, microfossils, and correlation, Lisburne Group, Arctic Alaska: U.S. Geological Survey Professional Paper 849, 144 p.

Armstrong, A. K., and Mamet, B. L., [in press], Carboniferous (Mississippian) Lisburne Group microfacies, Endicott Mountains, Arctic Alaska: Geological Association of Canada Special Paper 19 [in press].

Bowsher, A. L., and Dutro, J. T., Jr., 1949, Preliminary report on the Mississippian rocks of the Kanayut, Nanushuk and Itkillik Lake areas, Alaska: Preliminary Report 24: U.S. Geological Survey open-file report, 41 p., 3 figs., map scale 1:96,000.

Brosgé, W. P., Dutro, J. T., Jr., Mangus, M. D., and Reiser, H. N., 1962, Paleozoic sequence in eastern Brooks Range, Alaska: American Association of Petroleum Geologists Bulletin, v. 46, no. 12, p. 2174-2198.

Detterman, R. L., 1976, Lithofacies fence diagram of Sadlerochit Group for Philip Smith Mountains quadrangle and adjacent areas, northeastern Alaska: U.S. Geological Survey Miscellaneous Field Studies Map MF-744.

Hamilton, T. D., 1978, Surficial geologic map, Philip Smith Mountains quadrangle, Alaska: U.S. Geological Survey Miscellaneous Field Studies Map MF-879A, scale 1:250,000.

Imlay, R. W., 1961, Characteristic lower Cretaceous megafossils from northern Alaska: U.S. Geological Survey Professional Paper 335, 74 p., 20 pls.

Imlay, R. W., 1967, The Mesozoic pelecypods Otapiria Marwick and Lupherella Imlay, new genus, in the United States: U.S. Geological Survey Professional Paper 573b, 13 p.

Jones, D. L., and Grantz, Arthur, 1964, Stratigraphic and structural significance of Cretaceous fossils from Trigukpuk Formation, northern Alaska: American Association of Petroleum Geologists Bulletin, v. 48, no. 9, p. 1462-1474.

Keller, A. S., Morris, R. H., and Detterman, R. L., 1961, Geology of the Shaviovik and Sagavanirktok Rivers region, Alaska: U.S. Geological Survey Professional Paper 303-d, p. 169-222, map scale 1:125,000.

Oliver, W. A., Jr., Merriam, C. W., and Churkin, Michael, Jr., 1975, Ordovician, Silurian and Devonian corals of Alaska: U.S. Geological Survey Professional Paper 823-B, 44 p., 25 pls.

Patton, W. W., Jr., and Tailleur, I. L., 1964, Geology of the Killik-Itkillik region, Alaska: U.S. Geological Survey Professional Paper 303-c, p. 409-500, map scale 1:125,000.

*Since this map was published the formal name Beaufcup Formation has been given to units Dbs, Dbl, Db and Dbc (Dutro and others, 1979, U.S.G.S. Bull. 1482-A) but not to unit Dbw.

GEOLOGIC SYMBOLS

Contact - Dashed where approximately located; dotted where concealed; dotted and dashed where inferred from aerial photographs. Probably includes some faults

Fault - U, upthrown side; D, downthrown side. Dashed where approximately located; dotted where concealed; queried where doubtful; dotted and dashed where inferred from aerial photographs

Thrust fault - Sawteeth on upper plate. Dashed where approximately located; dotted where concealed; dotted and dashed where inferred from aerial photographs

Anticline - Approximately located. Showing crestline and direction of plunge

Overturned anticline - Approximately located. Showing direction of dip of limbs and plunge

Syncline - Approximately located. Showing troughline and direction of plunge

Overturned syncline - Approximately located. Showing direction of dip of limbs

Strike and dip of beds
- Inclined
- Horizontal
- Estimated strike and dip
- Estimated strike and direction of dip

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